

Air pollution takes a double toll on babies' brains



Children born and raised near inner-city pollution sources can wind up with reduced white matter in their brains and greater developmental and behavioral problems, a study suggests. Above, a Long Beach school near an oil refinery, freeway, railroad line and seaport. (Don Bartletti / Los Angeles Times)

This is your baby's brain on air pollution: White matter goes up in smoke

Minorities, inner-city residents suffer from pollution's effects on brain, study shows

A common pollutant in vehicle exhaust, power plant emissions and cigarette smoke can shrink white matter in fetal brains and cause developmental damage during the toddler years, a new study suggests.



In 40 children examined by researchers, prenatal exposure to [polycyclic aromatic hydrocarbons](#) was correlated with reduced white matter on the left side of children's brains during their early childhood. Those physical changes in the brain's internal wiring also were correlated with slower cognitive processing and with symptoms of attention deficit and hyperactivity, according to the [study](#) published Wednesday in the journal JAMA Psychiatry.

“They tend to be fidgety and hyperactive and very impulsive, so they leap before they look,” said Dr. Bradley Peterson, director of the Institute for the Developing Mind at Children's Hospital Los Angeles and the lead author of the report.

The researchers had previously tied behavioral and cognitive problems to eight common types of these pollutants, which are a product of incomplete combustion of organic materials. The new study now suggests those problems have a biological root in the altered architecture of the brain.

The research involved 655 New York City women of Dominican and African American descent who gave birth between 1997 and 2006. During late pregnancy, the women carried detector backpacks that measured exposure to PAHs over 48 hours. Their children later were tested for exposure and underwent several rounds of cognitive and behavioral testing.

For the JAMA Psychiatry study, Peterson and his colleagues selected a representative sample from the original study group: 20 children whose own PAH readings were below the median and 20 whose PAH levels were above it. All the children were about 8 years old when they underwent magnetic resonance imagery scans.

Those scans showed that white matter was significantly reduced from normal volumes throughout the left hemisphere, an area that controls language and cognition, among other higher functions.

In fact, the higher their prenatal exposure to PAH was, the more white matter was reduced and the more acute the behavioral and developmental problems were, the study found.

Scientists don't know why the left side seemed to be affected more, but they suspect the compounds interfere with an early biochemical process that helps the fetal brain divide into slightly asymmetrical hemispheres.

The damage, however, is not isolated to prenatal stages, or to the left hemisphere. Postnatal PAH exposure, measured at age 5, correlated with diminished white matter in areas of the prefrontal cortex of both hemispheres, the study found.

“It's a double hit,” Peterson said. “They have the abnormality from prenatal life throughout the left hemisphere and then on top of that they have this bilateral frontal hit from exposures around age 5.”

The 40 children were from nonsmoking homes and had little or no exposure to lead or insecticides that likewise have been linked to developmental and behavioral problems, according to the study. All were right-handed.

Although it remains possible that other pollutants could be affecting the results, the researchers said their sampling methods eliminated the major contenders, helping to isolate the effects of the PAH compounds.

Numerous studies have linked air pollution — especially particulate matter — to respiratory and cardiac problems. But over the last decade, researchers have accumulated more evidence that particles and other types of airborne pollution can affect brain development.

A 2012 study using a database of 19,000 nurses found greater cognitive decline among older women exposed to high levels of particulate matter. A 2011 Boston study involving 680 men showed similar results. A series of studies involving children in Mexico City linked air pollution with the brain inflammation that is typical of diseases such as multiple sclerosis.

“It is worrisome,” Peterson said of the latest findings. “California has gone a long way toward improving and cleaning up the air, but there’s a long way to go. Future generations depend on it.”